**Lesson Plan #\_\_1\_ of Unit #\_2\_\_**

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| **TOPIC/TITLE OF LESSON** | **Mars: Getting There** | |
| **AUTHOR(S)** | **Judy Orr** | |
| **GRADE LEVEL(S)** | **4 and 5** | |
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| **APPLICABLE PA CORE OR NEXT GENERATION STANDARDS:** | | |
| **S6.A.1.1.1: Explain how certain questions can be answered through scientific inquiry and/or technological design.**  **3.2.4C: Recognize and use the elements of scientific inquiry to solve problems.**  **3.8.4.A: Know that people select, create, and use science and technology and that they are limited by social and physical restraints.**  **S3.A.2.1.2: Make predictions based on observations.**  **3.2.4.D: Recognize and use the technological design process to solve problems.**  **S3.A.2.1.3: Identify the variables in a simple investigation.**  **S4.A.3.2.2: Use models to make observations to explain how systems work.**  **CC.3.5.6-8: Compare and contrast information gained from experiments, simulation, videos, or multimedia resources with that gained from reading text on the same topic.**  **2.4.5B: Use if…then statements to express conditional relationships**  **2.5.5.A: Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense , and explain how the problem was solved in grade appropriate contexts.** | | |
| **LESSON OBJECTIVES:** | | **ASSESSMENT(S) EVALUATE**  **(formative and/or summative)** |
| 1. **To demonstrate an understanding of the Engineering Design Process while utilizing each stage to successfully complete a team challenge.** 2. **Construct a science question requiring a technological design** 3. **Design and construct a launch vehicle** | | 1. **List details about Mars pertinent to the design of a launch vehicle. Share and post ideas on chart paper.** 2. **Design and build a prototype launcher vehicle that will launch a satellite to Mars.** 3. **Conduct trials for length of straw, then another variable chosen by the team. Record results of each trial.** 4. **Group project evaluation paper.** 5. **Rubric for design anddescription** |
| **ACTIVATION OF PRIOR KNOWLEDGE (RTOP #1) ENGAGE** | | |
| 1. **While Mars is only a “stone’s throw” across the solar system, sending a manned mission to Mars is still just a dream. In order for that dream to become a reality, we need to study, investigate, theorize, construct, and test many factors. In the last unit, we studied background information, terrain, the presence of water, water filtration, and plants. Now we need a means of transportation to get us to Mars.** 2. **First we need a launch vehicle to send a payload to Mars. Then we need to design a means to attach the satellite (payload). Before we start today’s challenge, let’s review some background information about Mars, launchers, and satellites that will help us with our mission. You will be viewing three video clips.** 3. **You are expected to take notes during these video clips, as your design challenge will be based on your notes (research) and any additional research, as needed.** 4. **4. After the video clips, you will be breaking into groups of four to make a list of details needed for an effective launcher and satellite.**   **Videos:**  **Here is NASA’s Three-Step Plan for Getting Humans to Mars**  [**http://www.washingtonpost.com/news/speaking-of-science/wp/2015/10/9hereis**](http://www.washingtonpost.com/news/speaking-of-science/wp/2015/10/9hereis)**...**  **You Tube: How Long Does It Take to Get to Mars?**  [**https://www.youtube.com/watch?v=mpOJ6fQOrol**](https://www.youtube.com/watch?v=mpOJ6fQOrol)  **Hibernation Space Could Carry First Humans to Mars**  **www.cnn.com/2014/10/07/tech/.../mars-hibernation-flight**   1. **Now let’s discuss our notes in groups and post our information on the chart paper.** | | |

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| **TEACHING AND LEARNING APPROACHES EXPLORE, EXPLAIN, EXTEND** | |
| **WHAT IS THE TEACHER DOING?**  **RTOP (# 2-10; #9-12; #21-25** | **WHAT ARE STUDENTS DOING?**  **RTOP (#11-19)** |
| 1. **Now that you have shared the information you gathered from the video clips and the charts are displayed around the room, it is time for your team challenge: Design, build, and test a launch vehicle to send a payload to Mars. Your payload will be the satellite we constructed in unit 1.** 2. **The launch vehicle will be a balloon rocket designed to launch down a fishing wire.** 3. **Please read the packet of background information and the list of design constraints.** 4. **In addition to assembling the balloon rocket, your team must determine the best way to attach your satellite to the balloon assembly and then launch it down the fishing wire.** 5. **Your constraints include:** 6. **Changing the length of the straw between trials** 7. **Once you decide on n appropriate straw length, select and modify only that element during the rest of your trials. When choosing an element, think about the element that would improve speed, accuracy, or both.** 8. **Some suggested rocket elements are:**   **. number of balloons**  **. type of balloons ( round, long)**   1. **Now let’s watch two short videos about spacecraft structures before you begin the planning and design process.**   **Spacecraft Structures – You Tube**  [**https://www.youtubecomwatch?v=dqErjtCVP5c**](https://www.youtubecomwatch?v=dqErjtCVP5c)  **http:www.nasm.si.edu/exhibitions/gal114/gal114.htm**    **7.Distribute “Ask, Imagine, Plan” sheet Circulate among groups to answer questions, offer suggestions, pose questions.**  **8.As each group completes the “Ask, Imagine, Plan” sheet, the teacher meets with each group to approve the plan or have the group revise elements of the plan that are vague.**    **9.As each group gets their plan approved, the teacher gives each member of the group a paper to draw the balloon rocket assembly including the satellite.**  **10.Teacher meets with each group to approve drawing, pose questions, or offer suggestions.**  **11. Teacher circulates to observe construction and testing, offer suggestions, pose questions**  **12. Teacher circulates to observe construction and testing of variables, offer suggestions, pose questions.**  **Vocabulary: launch, payload, satellite,**  **Materials:**  **Straws – various sizes and materials (ie. Wax, plastic,etc.**  **Balloons- various sizes, shapes, thickness**  **Fishing line – 10 feet per group**  **Paper clips – various sizes**  **Variables each group wants to introduce**  **Satellite each group constructed in the previous lesson** | 1. **Students listen, take notes, ask questions** 2. **Students listen, take notes, ask questions**   **3.Students read packet, add to**  **their notes, ask questions.**  **4.Ask questions for understanding.**  **5.Ask questions for clarification.**  **6.After videos, group members discuss any extra notes/ ideas to add to the chart**  **7Groups work on “Ask, Imagine, Plan” sheet questions:**   1. **What questions do you have about today’s challenge?** 2. **How will you choose what length to make the straw?** 3. **Predict how the effect of the length of the straw on the launch assembly ight change the launch distance of your satellite.** 4. **What is the next rocket element or variable you plan to test?** 5. **Predict what will happen when you make these changes.**   **8.Upon completion of the “Ask, Imagine, Plan” sheet, each group conferences with the teacher for plan approval or to determine that certain questions need further clarification.**  **9. Group members discuss the criteria for their balloon rocket , then each member draws a model. Members share their models to determine the elements to be used in the group model.**  **10. Each group submits a drawing for approval by the teacher.**  **11.Groups construct and test the balloon rocket assembly, recording length of straw, distance traveled, and predicting velocity.**  **12. Groups construct and test the ballon rocket assembly for the second variable, recording distance traveled, predicting velocity, and recording any other changes .** |
| **WRAP UP RTOP (#14) EXTEND** | |
| **Each team will present their design, support for their design, results of the testing, and describe their variable. Then each group will demonstrate how their launcher rocket works. In addition, each group will include an evaluation paper which includes suggestions for future modifications.**  **Extension:**  **When the groups have completed their sketches and descriptions of how the launcher works, each group chooses one person to present what the group designed. Each group will also choose another member to serve on a “NASA Committee ”for selecting which launcher to build. Committee members can deliberate on the merits of each design.** | |

Refer to the RED text in the headings to see how the 5 E’s correspond to the lesson plan components. It is the teacher’s prerogative where extension activities are addressed.

**Rubric for Lesson Plan #\_\_1\_ of Unit #\_2\_\_**

***Instruction: Use the rubric below to review your lesson against the indicators listed below. Consider how someone unfamiliar with your unit would rate your work. Place a checkmark in the appropriate rating box.***

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| **RTOP**  **Indicator** | **Indicator Description** | **Thoroughly**  **Addressed** | **Adequately Addressed** | **Some Evidence** | **No Evidence** |
| \_ | Aligned with PA Core or Next Generation Science Standards | **X** |  |  |  |
| \_ | Strong correlation between lesson objectives and assessment methods |  | **X** |  |  |
| \_ | Incorporates NASA content and/or resources within the lesson | X |  |  |  |
| \_ | Integrates available technology |  | **X** |  |  |
| #1 | Provides opportunities to help students to activate prior knowledge |  | **X** |  |  |
| #2 | Structures lesson to engage students as members of a learning community | **X** |  |  |  |
| #4, #5 | Utilizes a problem based/inquiry learning model in which students make predictions, estimations and /or hypotheses with a means for testing them | **X** |  |  |  |
| #12, 14 | Describes structured activities requiring student exploration, self-assessment, elaboration and reflection | **X** |  |  |  |
| #11, 16 | Indicates how students will use a variety of means to represent phenomena |  | **X** |  |  |
| #10 | Connects with other content discipline and/or real world phenomena | **X** |  |  |  |
|  | Incorporates the use of modeling, guided practice and independent practice | **X** |  |  |  |
|  | Identifies and/or provides an authentic real-world problem relevant to the students for them to solve | **X** |  |  |  |
|  | Addresses each of the 5 E’s—engage, explore, explain, extend, and evaluate |  | **X** |  |  |